



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

THE SCIENTIFIC MONTHLY

JANUARY, 1919

WEATHER CONTROLS OVER THE FIGHTING DURING THE AUTUMN OF 1918¹

By Professor ROBERT DeC. WARD

HARVARD UNIVERSITY

THE Allied advance on the western front, which began on July 18, continued into the autumn with remarkable success until the ending of the war. Almost every day brought the news of a gain of territory; of the recapture of towns and villages; of the taking of prisoners and of guns. It seemed as if weather conditions, however unfavorable, could hardly make any difference in the carrying on of so aggressive a campaign, yet the autumn of 1918 was, in many respects, the most critical season, meteorologically, of any period of equal length during the whole war. It is easy to understand why this was the case. In the preceding years of the war, the winter storms, and cold, and mud on the western front necessitated a decided slackening of military operations between about the middle of November and early December. This happened in spite of emphatic

¹ Continued from THE SCIENTIFIC MONTHLY for October, 1918, p. 298.

Author's Note.—This series of papers on the weather factor in the Great War comes to a conclusion with the signing of the armistice by Germany. In the preparation of these articles, published in THE SCIENTIFIC MONTHLY and elsewhere, the writer had two things in mind. It was his belief that, as a part of the scientific history of the Great War, as full an account as possible should be kept of the meteorological conditions which affected the operations on all the battle-fronts. The other object was a practical one. It was felt that a discussion of the climatic conditions of the various war zones, and of the meteorological difficulties which were likely to affect, and which did affect, military operations, might be of some help in our own preparation for and conduct of the war. The facts set forth in these papers were collected from all available, reliable sources of information, chiefly the official headquarters' despatches, and the letters of well-known war correspondents. Later, and more complete, information may indicate that some of the statements which the writer has made should be modified, but it is his belief that what has been included is essentially complete and essentially correct.

predictions, previously made by the military commanders, that the fighting would "continue as usual throughout the winter." The 1918 summer and autumn campaign on the part of the Allies was perfectly clearly a neck-and-neck race with the weather. It was the business of the Allies to force an overwhelming defeat of the German armies during the few remaining weeks of "fighting weather," and to make it impossible for the enemy to postpone the final decision until after another winter of relative inactivity. Again, in case a definite military decision should prove unattainable before winter, it was clearly to the advantage of the Allies to push on, beyond the area of destruction and desolation left by the Germans during the earlier part of their retreat, where there were no houses or shelters of any kind and no fuel, to the towns and large cities of eastern France and Belgium. Here adequate provision for billeting the soldiers could be made. The Hindenburg Line itself, with its elaborate concrete shelters and dugouts, was an important objective before winter, for this same reason. Mr. Charles H. Grasty, the well-known *New York Times* correspondent, in a cabled despatch from Paris, dated September 11, reported having asked a French military authority why the Allied troops did not rush ahead and crush the Germans at once. The reply was:

There's one Generalissimo whom all belligerents take orders from, General Mud. If we could continue summer weather conditions another three months, we might get a decision. But it's unsafe to reckon on more than five weeks of good offensive weather. From the Somme to the Channel the character of the soil renders the mud the worst in all creation after the autumn rains begin in good earnest.

The Germans, on their part, had every reason for prolonging the fighting until the advance of winter should delay the enemy pursuit, and bring a cessation of active operations. Germany would then be in a position to rest and to reorganize her forces, and to suggest peace negotiations on the basis of a stalemate on the western front. Both sides were thus fighting with the strongest possible meteorological pressure behind them. For both sides, everything depended on the time of the setting in, and upon the severity, of the winter.

During the first days of September, the despatches mentioned the "unprecedented dryness" of the season as having been remarkably favorable for the movement of the Allies' troops, guns, tanks and supplies. In the absence of direct meteorological records from overseas, it is impossible to determine whether the term "unprecedented dryness" was war-

ranted, but it is clear that the roads were in good condition and that the Germans tried to hamper the Allied advance by flooding, wherever possible. The autumn rains were, however, not long delayed. For about a week, following September 8, heavy storms and chilly winds swept the entire battle area, slackening the progress of the Allies but not stopping their steady, although slower, advance. The men were drenched to the skin, and "felt the wind like a knife-blade." Yet there was a blessing in the rain, well recognized by some of the troops, for it laid the dust which was blowing from the battlefields covered with dead bodies of men and of horses, and it prevented the explosion of many shells which struck in pools of water.

As the milder and more peaceful weather of summer on the western front gradually gives way to the stormier and more turbulent autumnal types, it is inevitable that active military operations should be oftener slackened, or even entirely interrupted. The fighting conditions are less favorable. The weather changes are more frequent and violent. The rain is more chilling, and snow and sleet begin to fall. Observation, on the surface or in the air, becomes more difficult, often even impossible, owing to clouds, or mist, or fog. Gunfire becomes inaccurate. Lower temperatures, especially during the autumnal nights, cause discomfort or suffering, and bring calls for warmer clothing and for fires. The traditional mud of Flanders makes the most serious trouble during the autumn rains, which are characteristic of that region. Flanders mud has played its part in every war fought over this same territory throughout history, and has over and over again proved a serious handicap in the present war. This mud is most troublesome in the colder months, for storms are then most, and spells of fine weather then least, frequent. The rains on the western front are not unusually heavy in the sense that they give a large annual rainfall, but they come fairly steadily throughout the year; the country is mostly very flat and poorly drained; the soil is quickly water-logged, and the trenches and shell-craters serve as so many reservoirs for collecting water. "Seas of mud," "quagmires," "morasses," "bogs" are expressions used to describe conditions which have prevailed since the war on the western front began. Incessant labor must be expended to keep the roads in condition for traffic. The rivers are frequently in flood, carrying away bridges and turning the lower lands into temporary shallow lakes. The relation between the weather and military operations, especially in autumn and winter, is like a see-saw. Spells of stormy weather and of deep

mud mean tremendous difficulties of transportation and of troop movements, and hence involve a slackening of operations. Spells of fine weather mean greater aerial activity; more intense artillery action, and more favorable conditions for all movements.

With the progression of the seasons, from summer to fall, it was inevitable that what has happened in the past four years on the western front would happen again in the autumn of 1918. There is no reason to suppose that the months of September, October and November of the present year were any more unfavorable, or brought any more rainfall, than they normally do, although the official despatches, and the war correspondents' cabled letters, lay unusual emphasis upon meteorological handicaps. This fact is, however, doubtless due to the intensity of the fighting, and to the tremendous effort which the Allied forces were making to bring the war to a successful ending before winter set in. It would be a tedious repetition to enumerate here all the many cases in which weather conditions controlled the military operations on the western front during the past autumn. The rains; the chilling winds; the low clouds; the fogs; the cold nights; the mud; the water-filled shell-craters; the flooded rivers; the swamps—all played their part. Sometimes weather conditions favored the enemy; sometimes they favored the Allies. On the whole, every bit of delay resulting from stormy weather and difficulties of transportation worked in favor of the enemy, for it gave him just so much more time to organize his retreat and remove his supplies, and it hampered just so much the Allies' progress in their pursuit of the retiring Germans. The successful elimination of the St. Mihiel salient by French and American troops just before the middle of September, although it occurred early in the autumn, furnished striking illustrations of the meteorological difficulties with which the armies had to contend. The advance was begun early in the morning after a rainy night, in a driving rain and mist which made aerial observation difficult, and was followed by a strong westerly wind which hampered balloon and airplane work. The roads were deep in mud, and the fields soggy. The movement of heavy guns and transports was very difficult, the mud proving too much for many of the tanks, although these were small and relatively light, and had a wide tread. "The infantrymen slipped and waded in pursuit of the retreating enemy." In spite of the bad weather, American bombers did effective work, driving down enemy airplanes and balloons and attacking German supply trains. The main road

of the enemy's retreat became congested because of the mud, and here the American aviators, flying very low, were able to use bombs and machine guns to good effect.

Over and over again, with almost wearisome monotony, the despatches throughout the autumn mention the extraordinary difficulties resulting from the bad weather and the mud. But throughout all the reports there runs the splendid story of the advance of the Allied troops in spite of all obstacles; and of the cheerful endurance, on the part of the men, of discomfort and suffering in the cold and wet. One despatch (September 12) mentioned the pouring rains which forced "the Allied airmen to cease their punishment of the Germans." On September 30 "wintry winds and rains, sweeping in from the North Sea," drenched the men, and chilled them to the bone. Under that date Mr. Philip Gibbs cabled to the *New York Times*:

There was wild weather last night, with a gale of wind blowing and heavy rainstorms over the battlefields. . . . It was bitter cold for the brave troops, and this morning some of them I met had chattering teeth, after a night without sleep, but they endure these discomforts bravely, and the vision of victory keeps them warm in soul, if not in body.

Advancing autumn brought the more stormy weather which is characteristic of October and November on the western front. Special mention was several times made of the extraordinary difficulties encountered by the American troops in the Argonne forest, where, in addition to the natural handicaps resulting from the terrain, there were the barbed wire, and traps, and machine gun nests, and "mud and rain—everlasting rain" (October 1). Many supplies had to be carried on the backs of the soldiers. "I guess he (the enemy) is as wet as I am, and that helps some" was the statement of an American soldier to a war correspondent. A cable despatch to the *New York Times* (October 1) contained this significant statement: "The elements continue unfavorable. To say that the continued rain is German weather is no figure of speech, for our supplies and guns and ammunition must be brought up through seas of mud. . . ." That such conditions hampered the Allies was generally recognized, and on one occasion (October 16) the Germans, "favored by the bad weather and bad roads" which slowed up the Allied supply trains, made a temporary stand on a line from the region north of Sissonne to Reims.

In the Flanders region, as a correspondent cabled on October 15, "the battle may be said to be almost as much against the weather and the mud as against the Germans. But, while this sort of sticky ground hampers the Allied troops, it hinders

even more the enemy, who is trying to move his materials away under a heavy fire and through the mired ground of the Flanders lowlands." That the Allied advance continued in spite of the extraordinary handicaps of weather, and mud, and difficult transport, is remarkable. Mr. Philip Gibbs cabled to the *New York Times* on October 23:

The British troops slogged through water pools and trudged down rutty roads with the mud splashing them to their neck, while lorries surged along broken tracks, swung around shell craters and skirted deep ditches. Gun teams with all their horses plastered to the ears with mud traveled through the fog to take up new positions beyond the newly captured towns. All this makes war difficult and slow, and what is most amazing is the speed with which the armies are following up the German retreat like a world on the move, with aerodromes and hospitals, telegraph and transport, headquarters staffs and labor companies, all the vast population and mechanism which make up modern armies, across battlefields like the craters of the moon to country forty miles from their old bases.

In the latter part of October the Germans were using a great deal of mustard gas against the American troops. This gas is reported to be especially dangerous in wet weather, because in damp air it remains long in the hollows, where the shells land, and it also burns through wet clothes more easily than through dry.

Two branches of military activity are peculiarly hard hit by stormy weather. Tanks can only be used with difficulty, if at all, in deep mud, and heavy rain and low clouds prevent almost all aerial work. Balloons are not sent up and airplane observers, when they fly at all, can see only when very close to the ground. "German weather" was reported November 4. Heavy rains forced the Allies to advance slowly. The increasing distances from headquarters to the front added daily to the tremendous task of repairing roads, and of maintaining transport. On November 5, because of bad weather, the Allied front line troops lost touch with the main body of the enemy. On the same day Field Marshal Haig reported: "In spite of a heavy and continuous rain our troops have pressed the retiring enemy forces closely throughout the day, driving the rearguards wherever they have sought to oppose our advance and taking a number of prisoners." Persistent and heavy rains, or thick mists, continued along the whole battle-front until hostilities ceased. In spite of "very difficult weather," and of the deep and sticky mud, the Allied troops continued to make remarkable progress. These unfavorable conditions were bad for the Allies, because the pursuit was slackened, as was clearly indicated in the despatches, but, as one correspondent emphatically expressed it,

"the imagination fails to conceive what it must be on the German side of the lines, where the retreating army looks back over its shoulders at the menace in pursuit, and where every block of traffic means terror, or death, or capture, because the British flying men are out, and the British guns are pounding the roads, and British troops are marching on."

Early morning fogs, or "mists," often served as a screen for the attacking troops. Such cases occurred on the British front, in the Douai-Cambrai region, on September 27, where the fog "assisted in bewildering the enemy"; on September 29, on the St. Quentin front, where the fog was so thick that it was impossible to see "the length of a gun-team ahead"; on the American front in the Argonne forest on October 1, when the small tanks came out of the fog, unexpectedly, "like phantoms," and fell on the Germans in the rear; in the sector south of Cambrai on October 8, where British, French and Americans launched an attack in a thick "mist" and fog. Again, on October 9, a fog "proved a big help" to the American attacking troops in the Argonne forest. On October 18, in the Le Cateau sector, "American tanks . . . crossed the Selle River in a dense fog, steering by compass, leading the attack against the Germans. Prisoners said they were overcome by the suddenness of the arrival of the tanks in the fog." Other cases occurred on October 24, on the American front, and also on the British front in Flanders. The "thick wet fog" in the latter case was reported as very much in favor of the attacking troops, for it "blinded" the German machine gunners. November 1 and November 3 furnished further illustrations of similar conditions on the American front. In the advance on Landrecies the tanks had to steer by compass through the dense white fog of early morning. One report (November 8) mentions the fact that, owing to an all-day fog, American aviators were unable to keep watch on the retreating enemy, and this aided the German withdrawal.

The effect of spells of fine weather must not be lost sight of. In the midst of the storms, which are the dominant condition on the western front in the autumn months, the rarer spells of dry, clear weather are peculiarly welcome, and exert marked controls over military activities. Thus, on September 15-16, fine weather, "with just the first touch of autumn in the wind at night" but with warm "perfect" days, was a welcome relief to the men, and a real help in the work of road-mending and of railway and camp construction. Every spell of fine weather brought increased activity, especially in the air. Un-

der date of September 27, Mr. G. H. Perris cabled to the *New York Times* from the French front:

It was a matter of universal congratulation that the morning fog had early given way before the bright sunshine. A mist at the hour of assault is not an unmixed disadvantage, for it covers the infantry advance and blinds the enemy machine gunners; but the importance of aerial observation, especially for the correction of artillery fire, has become so great that the momentary screen gained by the ground forces is no compensation for the crippling of the aviators. A burst of fine weather at such a juncture has also a considerable moral influence. No man is quite strong enough to be indifferent to accident; and, as when a vast and perilous venture falls upon bad conditions, those who must sustain it are discouraged as well as obstructed, so the happier turn of fortune is a double aid.

Good weather on October 1 "did wonders for us in the way of repairing the roads, and to-day's reports are that traffic conditions have improved 100 per cent. over two days ago, when, it may be stated, our service of supply was in a sorry plight through no fault of its own." The comfort of the men is obviously greatly affected by the weather conditions. Dry spells, with improved transportation, mean more regular and better meals, and dry blankets, to say nothing of the cheering effect of sunshine on the spirits of the men.

Preparations had been made for carrying on the war through the winter. Under date of October 4 it was reported that most of the American troops had been supplied with sleeveless, felt-lined leather coats, "while trucks moving from the rear bore ton upon ton of overcoats." At the end of October, the Forestry Section of the A. E. F. promised to have ready by January 1, 1919, 100,000 cubic meters of fuel wood. This was to come from dead wood and from refuse in the forests. No fine trees were to be cut.

Early in October (third) the statement was made, in a despatch from overseas, that American naval officers looked for increasingly difficult times for the German submarines. In summer, by operating far out, the losses may have been reduced, as well as the successes, but the coming on of winter storms was expected to drive the submarines into more sheltered waters, where air patrols, and submarine chasers and destroyers would have a better chance to attack them. A good deal was said about the relatively small amount of aerial activity on the part of the Germans during the summer and early autumn. In explanation of this fact, some of the Allied aviators maintained that the enemy machines were being conserved by using them on cloudy days only. They could then navigate by

compass above the clouds; swooping down when necessary, and then disappearing again within the clouds. An interesting case of camouflage was reported in connection with the use by the Allies of figures of soldiers painted on thin boards, and cut out very much as paper dolls are cut out by children. During the night these silhouettes were placed out in open order in front of the lines, and on a foggy morning, being mistaken by the Germans for real men, usually drew the enemy's fire and thus revealed the position of the enemy's guns in advance of the attack.

On the Italian front there was little activity until late in October. Early in September (fifth), in the northern part of the Tonale Pass, there was hard fighting "among the eternal snow and ice." On September 25, Italians and Czecho-Slovaks made a surprise attack on the Asiago Plateau in a violent storm. On October 24 a new—and the final—Italian and Allied offensive began on the mountain front between the Brenta and Piave rivers, in unfavorable weather. The time of the year was certainly not propitious for a mountain campaign, for by late October the snowfall in the mountains is already considerable, and almost certain to cause serious difficulties of troop movements and of transport. The reason for beginning the offensive at that time was doubtless to be sought in the political condition of Austria-Hungary. On the other hand, on the southern Piave, winter fighting is quite possible, for the precipitation there is rain rather than snow. It may be that General Foch had planned the Italian offensive for a time when Austria's main lines of communication with the front should be blocked with snow. The weather in the mountains was reported as unfavorable (October 24–29), but the Italian troops were successful. The Italian statements regarding the operations on the Piave were rather guarded. Conditions had threatened a rise in the river, but with three successive days of fair weather (October 30) a large body of troops was able to cross the Piave, and continue their pursuit of the retreating enemy. The danger that a sudden fall of rain in the mountains would bring the Piave down in flood, as happened during the last Austrian offensive, did not occur, although there were reports on October 28 that operations had been checked by a rise in the river. Military operations on the Italian front ended when the armistice went into effect, November 4.

In Mesopotamia and Palestine the British forces achieved complete success. Because of the "closed season," resulting from the heat and drought of the summer, little was heard of

Gen. Allenby after the first of May, when he had taken Es-Sault, and had reached a point on the railroad about 110 miles from Damascus. Some details, not earlier available, have come through regarding the difficulties which were met with in the progress of the campaign which followed the capture of Jerusalem (early December, 1917). These facts are taken from a diary of a member of the Imperial Camel Corps, and were sent to this country by Mr. Allan Hunter, a member of the American Red Cross in Palestine. That being the rainy season in Palestine, the trouble, as was to be expected, was mostly with the rain and mud. Immediately after crossing the Jordan, "there was a huge dust storm, accompanied by rain, which made it very unpleasant." The men suffered greatly because of the frequent rains and cold. The mud became "simply atrocious." On one occasion the camels had to be pulled along by their bridles. "The trek was literally through feet of mud and water." Just before reaching Es-Sault "hailstones and bitter cold and the usual mud" were experienced. There is also reference to "very heavy dew, which went through bivvy sheet and valise and waterproof sheets." These heavy dews are a well-known climatic characteristic of Palestine, especially on the interior highlands.

Gen. Allenby started his autumn (1918) campaign very early (September 19), before the best season for military operations in Palestine usually begins, doubtless in order that he might have the whole of the campaign season before him. One point in the British advance is especially interesting. This being still the dry season, marching troops naturally raise clouds of dust, and their movements are thus revealed to the enemy. It was doubtless partly for this reason that Gen. Allenby's troops "were always moved by night, and remained hidden in the orange and olive groves in the daytime." In Mesopotamia, also, the hot summer was a time of relative inactivity, but with the coming of autumn the British forces advanced up the Tigris in coordination with the movements of Gen. Allenby's forces in Palestine. The result of the combined operations is well known. The Turkish armies were defeated, and Turkey was driven to surrender.

From Russia, in its state of chaos, but little trustworthy news has come through. As early as August 28 a despatch from Archangel referred to the work of an Allied commission which was then considering the question of supplying the people with winter clothing and with provisions. An interesting despatch (September 4) mentioned the arrival of American

troops at Archangel, most of them being "from States where the winters are like those of Russia." Under date of October 20, a press despatch from Archangel reported:

An unusually late winter in northern Russia was ushered in to-day by a heavy fall of snow. The Dvina and Vaga Rivers, which usually are closed at this date, are still ice free. The American and other soldiers are being equipped with semi-arctic uniforms, including sheepskin great-coats and Arctic felt boots.

In Siberia, preparations for a hard winter's fighting were being made early in September. American troops were then being fitted out with fur caps, mittens, overcoats and heavy fur-lined shoes. "They will wear the same clothing as troops stationed in Alaska." "Typical American fall weather" was reported as prevailing at Khabarovsk on the arrival of American troops there (October 14). From the American Government, through the Red Cross, 75,000 sweaters and overcoats for the Czecho-Slovak troops arrived in Vladivostock on October 16. As an "emergency relief," other supplies of warm clothing had been previously distributed to these troops. One of the most difficult questions confronting the Allies in Siberia was that of transportation by the Trans-Siberian road during the severe cold and icy gales of winter.

From the Balkans there were very few reports of meteorological interest. Quick work by the Allied troops was imperative, for the winters of the Balkan mountains begin early, and are severe. Increasingly unfavorable weather was noted early in October. The ending of the war before mid-autumn came at the time when military operations in the Balkan highlands are usually beginning to be seriously interfered with by bad weather.

Thus ends the meteorological chronology of the war which has been the subject of the present series of articles. When the complete scientific history of the Great War comes to be written, by no means the least important, or least interesting chapter will be that which relates to the weather controls over the operations on all the fronts. It is the hope of the writer that the facts which he has collected and summarized in the series of articles now ending may be a helpful contribution to the more complete discussion which may follow.